

I. INTRODUCTION TO THE SYNCLAVIER (R)
DIGITAL MUSIC SYSTEM

--Preliminary Version--

November 21, 1984

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CONTENTS OF THIS MANUAL

This section will introduce you to the Synclavier (R) Digital Music System. It will provide you with an overview of the entire system and explain how the different hardware and software components work.

In addition you will learn the basics of

- loading the system;
- using the button panel and keyboard;
- recalling and playing timbres from diskettes;
- changing sounds through real-time effects;
- modifying timbres;
- using the memory recorder.

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THE SYNCLAVIER (R) DIGITAL MUSIC SYSTEM - AN OVERVIEW

Welcome to the Synclavier (R) Digital Music System.

The Synclavier (R) is a complete music production system and can perform many different functions.

The Synclavier (R) is a keyboard instrument.

You can perform live on the Synclavier (R) keyboard unit immediately. Velocity and pressure sensitive keys as well as pitch and mod wheels, ribbon controller, and pedals may be used to enhance your performances.

The Synclavier (R) is a synthesizer.

Hundreds of sounds are at your fingertips. The Synclavier (R) can authentically produce the sounds of traditional instruments as well as unique sounds. Synthesizing your own sounds is easy to learn.

The Synclavier (R) is a multi-track production system.

You can use the Synclavier (R) digital memory recorder to perform all the functions that go into the production of a finished piece of music: A 32-track piece can be composed, performed, arranged, recorded, edited, and mixed in a remarkably short time.

The Synclavier (R) is a copyist.

After you record a piece on the keyboard, the Synclavier (R) can transcribe it automatically into professional notation.

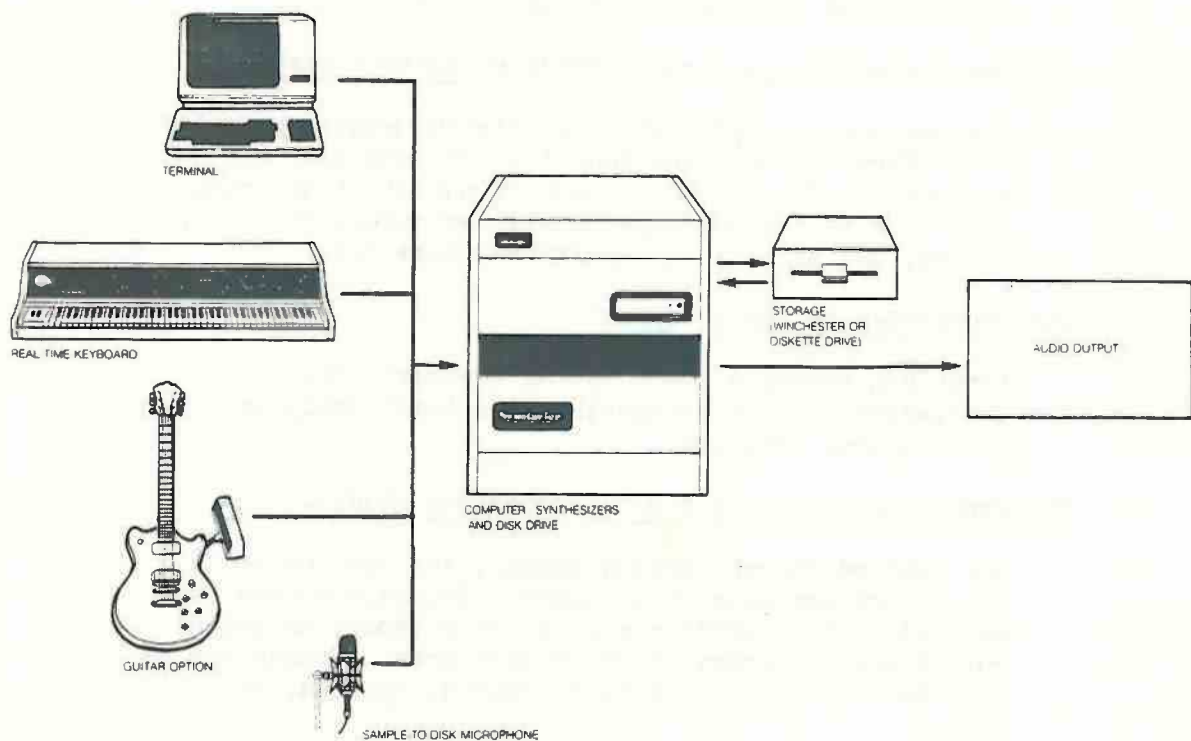
The Synclavier (R) is a digital recording studio.

Not limited to synthesized sounds, the Synclavier (R) can record and play real sounds. Recorded sounds can be used in live performance on the keyboard or Roland guitar and in memory recorder sequences. Sounds can be used as recorded or can be dissected, spliced, and mixed.

The following chapters introduce the major hardware components and software options in the Synclavier (R) Digital Music System as well as the manuals which describe how to use them.

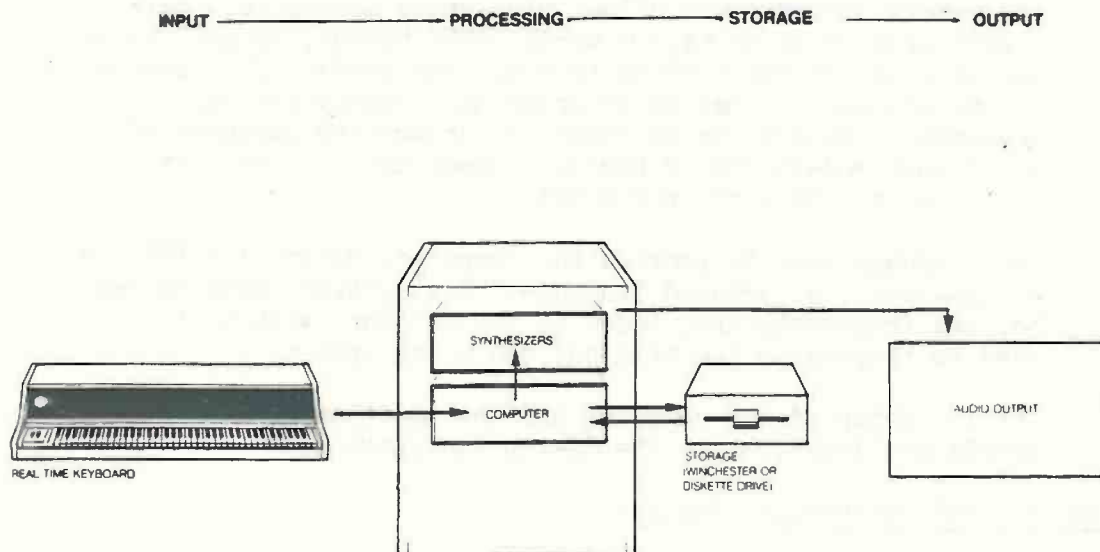
THE SYNCLAVIER (R) HARDWARE

The Synclavier (R) Digital Music System is made up of a set of related computer and digital audio processing modules. The system can be configured in a number of ways, each tailored to the individual applications for which it will be used. Below is an illustration of the major components.



Basic Hardware

Four hardware components form the basis of real-time (live) performance on the keyboard and are required for all Synclavier (R) Systems. These are the Velocity/Pressure Keyboard Unit, the computer, the digital synthesizer modules, and the disk drive or drives.



The Velocity/Pressure Keyboard Unit

The Velocity/Pressure Keyboard Unit is the primary interface between the musician, studio technician or composer and the Synclavier (R) Digital Music System. A musical instrument first, it includes a 76-key velocity and pressure sensitive keyboard, plus several other assignable real-time effects, such as ribbon controller, pitch and mod wheels, and breath controller. The buttons and the knob on the Keyboard Unit are used to program or modify sounds and to operate the 32-track recorder.

This "Synclavier (R) User Guide" focuses on how to use the Keyboard Unit.

The Computer

A computer used for professional music synthesis and performance must carry out a variety of functions instantly and simultaneously. The Synclavier (R)'s computer, known as the ABLE series, has been specifically designed at New England Digital to carry out these functions efficiently.

The power of the ABLE series computer is based on its true 16-bit mini-computer design, which is far more powerful than the 8-bit micro-computers commonly used in personal

computers. The central processor in the ABLE computer is one of a series of compatible processors, each offering different performance levels. To insure headroom for the software and hardware enhancements that will be offered over the years, the new high-speed ABLE model C is under development. Model C will permit increased speed in performance as well as additional synthesis controls and features.

The memory architecture allows high-speed access to a main memory area of up to 64,000 words (128K bytes), as well as an extended memory space of up to 8 million words. This memory allows storage of complex programs and lengthy musical sequences. Memory can be expanded through the purchase of additional add-in memory boards. These are available in sizes up to 128K words per board.

The language used to program the computer, Scientific XPL, is a high-level, structured language. New software modules can be, and frequently are, added to the software without the need to re-program the original operating system.

Initial setup of the computer and the addition of memory boards are described in the "Setup Instructions."

The Digital Synthesizer Modules

Packaged along with the computer are the digital synthesizer modules. These unique modules are based on patented digital signal processing technology. They provide an extremely rich range of sounds and control functions, and their high frequency resolution provides for glitch-free portamento and vibrato. Both additive and FM synthesis can be performed by the synthesizers.

The digital synthesizers generate a series of numbers which are converted by digital-to-analog converters into actual audio waveforms. For professional quality sound, the numbers must be generated at extremely high rates (32 kHz minimum). If every number were individually computed, the necessary rate of computation would exceed the capability of even a powerful computer. In the Synclavier (R), the computer determines the properties of each sound (its harmonic content, volume envelope, duration, pitch, etc.), and transfers this information to the synthesizers in the form of a compact set of digital code. The digital synthesizers then carry out the repetitive tasks of generating the digital waveforms.

Each synthesizer module contains eight independent channels or voices. It is built on four synthesizer boards plus one or two output boards. If there is one output board, the channels are mono, while two output boards allow stereo channels. Units can be upgraded from mono to stereo in the field, and more voices can be added to the system at any time by installing more synthesizer boards. This procedure is described in the "Setup Instructions."

Disk Drive Options

All Synclavier (R) systems rely on permanent disk storage for sounds, sequences, finished tracks, programs, and so on. Many disk configurations are available. Although it is possible to operate from a single floppy diskette drive, a typical system has one or two floppy diskette drives and a Winchester disk as well.

Since floppy diskettes can be removed from the drive, they can be used to build up a portable (and mailable) library of sounds and compositions. The Winchester disk, which has faster access and more storage space, is used to hold copies of frequently used sounds and programs, and various work in progress. Sampled sound files, as collected by the Sample-to-Disk (tm) option described below, can only be captured on a Winchester disk.

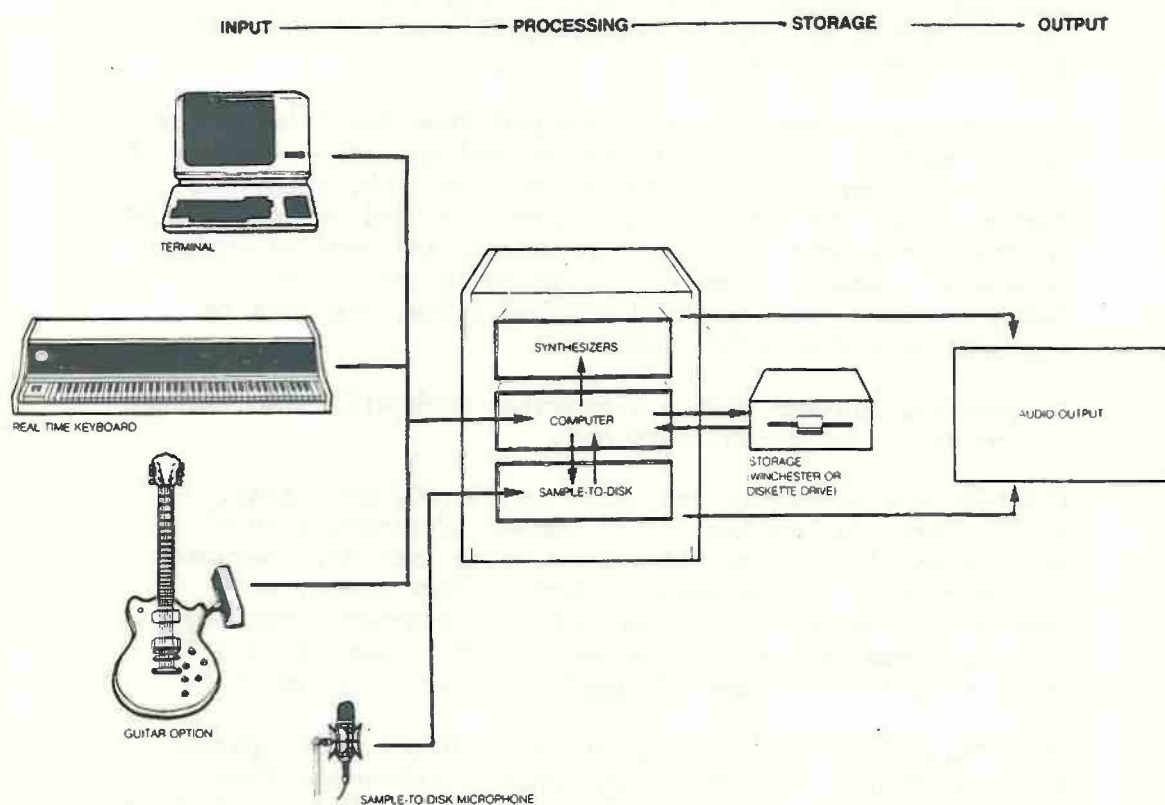
Frequently, systems with a Winchester disk will also include a tape drive for backup purposes.

Floppies are currently available in 200,000 byte size. Winchester disks are available in a number of sizes, with 10 million and 15 million byte sizes being typical. Because customers will always require more storage space, we continually search for advancements in storage technology, both in terms of speed and capacity. For example, a 2.7 million byte size "super-floppy" is under development.

This "Synclavier (R) User Guide" describes how to operate with one floppy disk drive; you should understand this procedure first. The "Introduction" to the Terminal Support Options (Binder 2) describes operation from a computer terminal in combination with anywhere from two to several disk drives, floppy or Winchester. You should read this before turning to the Sample-to-Disk (TM) System (Binder 3), since that manual assumes that you have a Winchester disk.

Hardware Options

Several options can be added to the Synclavier (R) Digital Music System.



Computer Terminal

A graphical or alphanumeric computer terminal can be a great aid for the keyboard synthesist, because it can provide a complete, real-time display of the parameters of a sound as you change them. For information on how to use this option, see the "Timbre Display System" manual in this binder.

The terminal can assume a more central position in the system with any of the "Terminal Support Options." For example, with the SCRIPT option, you can use the terminal to type in musical compositions and to edit sequences played on the keyboard. You can go back and forth between the terminal (not real time) and the keyboard (real time) by typing simple commands on the terminal.

Or, with the Music Printing Option, you can automatically transcribe music recorded from the keyboard (or guitar) or typed in at the terminal. This Option requires a graphical terminal.

Finally, you can customize the operation of all the Synclavier (R) hardware by writing your own programs in the MAX language.

The Terminal Support Options (Binder 2) describes all these possibilities.

Digital Guitar Control Unit

The Digital Guitar option provides a link between a Roland GR Guitar* and the Synclavier (R) Digital Music System. With this option, the guitar player can play Synclavier (R) sounds from the guitar instead of a keyboard and can access all the powerful capabilities of the Synclavier (R) Digital Music System. The use of this live performance option is described in the "Guitar User Guide" in this binder.

The Sample-to-Disk (tm) Module

With the addition of the Sample-to-Disk (tm) module, you will be able to record, analyze, and perform actual sounds, rather than synthesize them. The module contains 16-bit analog-to-digital and digital-to-analog converters and is distinct from the converters contained in the digital synthesizer modules described above. The module is housed in a separate box to reduce radio frequency interference and has its own separate output. The Sample-to-Disk option also requires a Winchester disk for storage of digital sound samples.

Instructions for use of the Sample-to-Disk (TM) system are contained in Binder 3.

This concludes the list of major hardware options. Other standard equipment, such as printers, pedals, switches, modems, and so forth can be incorporated into the Synclavier (R) Digital Music System as required.

* Roland GR is a registered trademark of Roland Corporation, Japan.

THE SYNCLAVIER (R) SOFTWARE

As with all computer systems, the key element for successful operation is the software. The software for the Synclavier (R) can be divided into two types: system and user.

The system software consists of the computer program, or operating system, which runs the Synclavier (R). This software consists of all the functions which allow you to perform, record, edit and store sounds and musical sequences.

The user software consists of the actual sounds and sequences that you create and then store on the diskettes. To get you started, New England Digital supplies you with many preprogrammed sounds (these are called timbres), as well as some demo sequences, which can be recalled, played and modified.

When you receive the Synclavier (R) Digital Music System, you will receive copies of both system and user software on floppy diskettes and, if you have one, on the Winchester disk.

Loading an Operating System

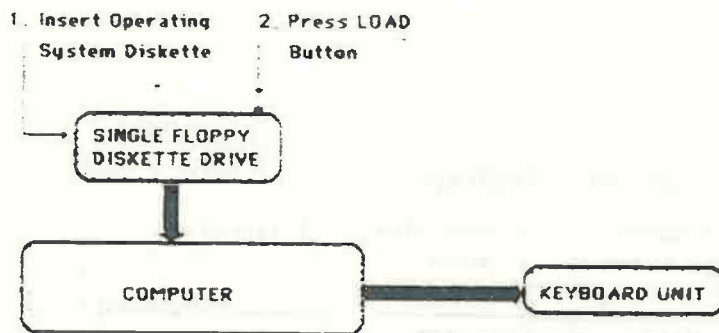
Any diskette with an operating system stored on it is called a system diskette. To run the Synclavier (R), you place one of these in the disk drive, press the LOAD button, and the operating system will be transmitted to the computer. This is called loading the operating system and is described in detail in "Loading the System."

There are many different operating systems. Each one is stored on a different system diskette and causes the Synclavier (R) to behave in a different way. You can go from one method of operation to another simply by loading a different operating system.

Loading a Real-Time Performance Operating System

When you load from a Real-Time Performance operating system diskette, you will activate the Velocity/Pressure Keyboard Unit and be able to play and record all the preprogrammed timbres. There are several versions of the real-time system. The basic version activates the keyboard. Others activate the guitar or include software for terminal displays of timbres and recorder sequences. However, all real-time operating systems activate the keyboard as soon as you press the LOAD button.

SINGLE DRIVE LOADING



Loading A Real-Time Performance Operating System

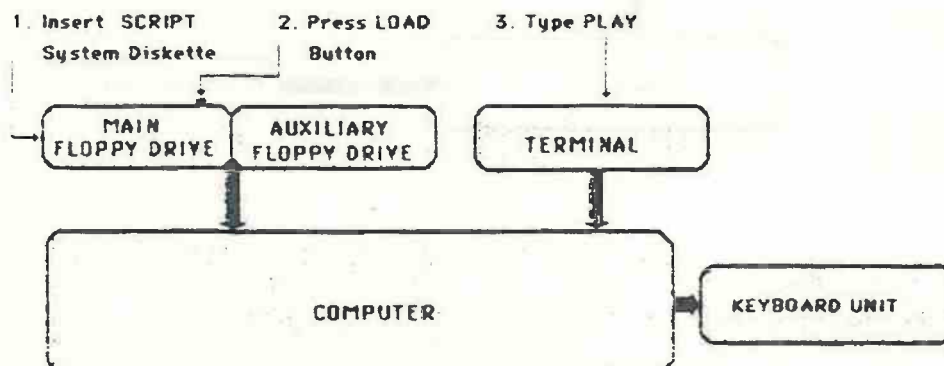
Activating the Real-Time Performance System from the Terminal

When you load the operating system from any SCRIPT system diskette, you will operate, initially at least, from a computer terminal. The keyboard will not be immediately activated.

However, each SCRIPT system diskette does contain a version of the Real-Time Performance system software on it. After loading from the SCRIPT system diskette, you activate the Real-Time Performance system by typing the SCRIPT command PLAY.

Different SCRIPT diskettes have the different versions of the Real-Time Performance system on them. By loading from the appropriate diskette, you will be able to activate the desired Real-Time system.

DUAL DRIVE LOADING

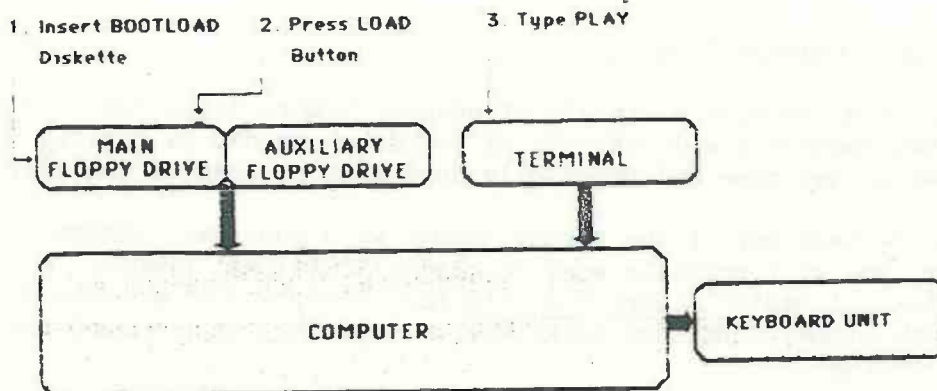


Activating Real-Time Performance from the Terminal - Dual Floppies

Loading from a Winchester is slightly different, since it contains all the software options that you may use with your hardware. The equivalent of a series operating systems from several of floppy diskettes will all be "on line" ready for access.

You use a special "bootload" diskette which tells the computer to load an operating system from the Winchester, rather than from the floppy itself. Once you have loaded, you may activate any of the installed software modules with SCRIPT commands. You can activate the basic Real-Time Performance system, or the Guitar Real-Time Performance version, or the Timbre Display version, and so on. Since the focus of this manual is on Real-Time Performance itself, it will not go into these commands. They are described in the "Introduction" to the Terminal Support Options (Binder 2).

WINCHESTER DRIVE LOADING



Activating Real-Time Performance from the Terminal - Winchester

Whether you load the Real-Time Performance system from a Real-Time system diskette or activate it from a SCRIPT system diskette or from the Winchester, once it's up and running, Real-Time Performance is basically the same. The buttons, the keys, and the knob on the Keyboard Unit will behave in the same way.

Configuring A System Diskette

The operating system on each system diskette must be customized for the hardware in your system: the amount of memory, the kind of terminal (if any), and so forth. This customization is done here at the factory for all new systems. However, if you should change the amount of memory in your system, or type of disk drive, you must "re-configure" your operating systems. For instructions on this procedure, see the "Setup Instructions."

Copying a System Diskette

It's a very good idea to make copies of all your system diskettes. Then use the copies to run the system and keep the originals for masters.

The Format & Duplicate diskette you received can be used to format a blank diskette (that is, prepare it for use) and to duplicate the contents of another diskette onto it. Instructions on using this diskette may be found in the Appendix of this "User Guide." If you have a computer terminal, you may also use the FORMCOPY program for this same purpose. FORMCOPY is found on your Utility Diskette and is described in the tabbed section "Utilities" in Binder 2.

Timbre and Sequence Diskettes

You will also receive a library of several timbre diskettes. These diskettes contain a wide variety of sounds which can be rapidly accessed at any time and repeatedly used with no loss of quality.

You may replace any of the preset sounds with your own timbres. However, you will probably want to create additional timbre diskettes. A Master Timbre Diskette has been provided for you to copy onto blank, formatted diskettes so that they may be used for timbre storage.

Similarly, you will receive two Master Sequence Diskettes. The first contains space for one long sequence. The second contains space for four shorter sequences. You will want to make copies of these diskettes before you begin recording so that you will have a place to store your sequences.

Instructions on formatting blank diskettes and on copying may be found in the Appendix of this "User Guide" and also in "Using the Utilities" in Binder 2. Instructions on storing timbres may be found in the tabbed section "Timbre Design." Finally, instructions on storing sequences may be found in the tabbed section "Memory Recorder."

For the 2.7 megabyte "super-floppy" that is currently under development, only pre-formatted diskettes may be used. Additional information will be included in a supplement along with the drive.

HELP!

While you are actually operating the Real-Time Performance system, you can press the INFO button and facts about a sound or a track in the memory recorder will be printed in the display window on the keyboard unit.

There is also a special KEYBOARD HELP diskette which uses the computer terminal to teach you about the Velocity/Pressure Keyboard Unit. If you load from this diskette, you can press any button on the keyboard unit and an explanation of the button will be printed on the terminal screen.

LOADING THE SYSTEM

CARE AND HANDLING OF DISKETTES

The diskettes provided by New England Digital Corporation are of the highest quality available. To achieve the maximum in data reliability, you must handle the diskettes carefully and store them in a dust-free environment away from magnetic fields.

1. Always store your diskettes inside the protective jackets provided. Dust on the recording surface can ruin the diskette.
2. Always keep diskettes at a temperature between 50 F and 125 F. For best results, keep them at room temperature.
3. Never expose diskettes to stray magnetic fields. Avoid such common devices as telephones, microphones, loudspeakers, dictation machines, as well as other instruments which contain small internal magnets.
4. Never bend or otherwise physically abuse a diskette.
5. Hold a diskette gently by the edges to avoid damaging the recording surface.
6. Never touch the exposed magnetic surface visible in the slot.
7. When inserting a diskette into the drive, hold it with the label up and the slot away from you. Be careful to insert it straight into the slot and never at an angle. The diskette should slide effortlessly into the drive. Any other condition indicates improper insertion.
8. Always remove diskettes from the disk drive before you turn the power to the computer on or off.
9. You may identify your diskettes by writing on the label. But always use a felt tip pen. Writing with a ball-point pen may damage the recording surface.

If you follow the above rules, your diskettes will be highly reliable. Any diskette that does become physically damaged by dirt, liquid, or rough handling should be replaced immediately, to avoid harming the internal mechanism of the disk drive. However, a diskette that has been magnetically erased by exposure to stray fields may be reformatted and returned to service.

LOADING THE SYSTEM

The following instructions describe how to load the Synclavier (R) Real-Time Performance operating system from a Real-Time operating system diskette. They assume that your Synclavier (R) system has been assembled and is operating properly, as described in the Setup Instructions.

Any Synclavier (R) Digital Music System can be operated as described below and we strongly urge you to begin operation by loading in this way. When you are comfortable with this method, you can then proceed to the Terminal Support Options and learn to operate either from dual floppies or from the Winchester.

NOTE: If the OUTPUT EQUALIZATION switches are installed on your computer, they should be in the -IN- position to produce the right sound for the preset timbres and memory recorder sequences on your diskettes.

NOTE: Always insert the diskette into the drive after turning on the power.

1. Turn on the computer.
2. Plug in the Velocity/Pressure Keyboard Unit.

At this point, the display window will show a pattern of lines.

3. Take the Synclavier (R) system diskette labeled

Operating System Disk
Velocity

and grasp it with the label up and the oval slot away from you.

4. Insert the diskette smoothly into the drive and lock. If you have two disk drives, use the left-hand or MAIN drive.
5. Press the LOAD button on the disk drive once and let go.

The Synclavier (R) Real-Time Performance operating system will now be automatically loaded into computer memory. While this is happening, you'll hear the drive motor for several seconds.

When the Synclavier (R) operating system has been successfully loaded, the following things will occur:

- a. A software release name, the number of synthesizer voices and amount of memory installed in your system will appear in the digital display window.
- b. The following buttons will be lit:
 - Button 1 under PARTIAL TIMBRE SELECT
 - ENTRY button under TIMBRE/SEQUENCE STORAGE
 - Button 1 under TIMBRE/SEQUENCE STORAGE
- c. When you press a key on the keyboard, you'll hear a sine wave.

If your system does not behave in this manner, please check to see that you have inserted a system diskette, not a timbre diskette. If the drive motor keeps running continuously, however, it probably means that the diskette is defective. Try another system diskette.

NOTE: You only have to press the LOAD button once during a session, unless you wish to load a different operating system. Then you must press the LOAD button again. Do not press the LOAD button when you insert a Timbre Diskette into the drive.

6. Whenever you are ready to stop Synclavier (R) operation, remove the system diskette from the drive before turning the power off. Electrical transients which occur when the power is turned on or off may generate stray magnetic fields that can corrupt the information stored on your diskette.

KEYBOARD BASICS

KEYBOARD BASICS

THE VELOCITY/PRESSURE KEYBOARD UNIT

As soon as your system is up and running, you will operate entirely from the Velocity/Pressure Keyboard Unit. You will recall and play the preprogrammed "timbres" (or sounds), program your own timbres, and patch in special real time effects. You will also record and edit sequences on the 32-track memory recorder. And, of course, you will perform live on the 76-key velocity and pressure sensitive keyboard.

Let's take a look at the unit.

The Control Knob and Display Window

In contrast to analog synthesizers, which have a separate knob for every function, the Synclavier (R) requires only one control knob for all of its functions. You can use it to increase the depth of vibrato in a sound, or to tune the keyboard, or to speed up the memory recorder, and so forth. All you do is first select the parameter you want to change by pressing one of the labeled buttons. Then turn the knob.

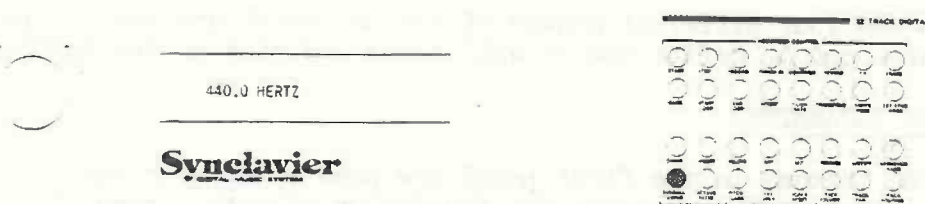
As soon as you turn the knob, you will be able to hear the change, either in notes played on the keyboard or in playback of a recorded sequence. You will also be able to see the change reflected in a new numerical value in the display window to the right. The display window will also tell you what units the parameter is measured in, that is, in milliseconds, dB, or semitones, or whatever.

No matter what function you are changing, the control knob always works in the same way. It is a spring-loaded knob and can be turned from about an 11 o'clock position to the left to 1 o'clock to the right. When you turn the control knob to the left, you decrease the numbers in the window. When you turn the knob to the right, you increase the numbers. The farther you turn the knob to the left or to the right, the faster the numbers change. Whenever you release the knob, the number currently displayed in the window will be memorized by the computer, and will remain in effect until you change the setting or turn off the system.

Tuning the Keyboard

Let's use the knob to tune the keyboard.

1. Press the OVERALL TUNING button located in the second panel in the bottom row. This action assigns the tuning function to the control knob. The display window will read



Every time you turn on the Synclavier (R) it will be tuned to A 440.0.

2. Turn the control knob to the right and play some notes. The whole keyboard is instantly tuned up.
3. Turn the knob to the left. The whole keyboard is tuned down again.
4. Dial 440.0 again before proceeding.

The display window has room for two rows of sixteen large dot matrix characters each. Besides providing an instant readout of parameter changes, the window will display other helpful information. It will count out the beat of the digital metronome during recording or playback and show you the number of notes you have left in the memory recorder. From time to time, the window will also display various error messages.

You can also press the INFO button to put the keyboard in a special information mode for the keyboard. In this mode, for example, if you press a track button, the window will tell you the timbre on the track and the number of notes on the track.

The Buttons

Although there are many different buttons, they fall into three basic categories:

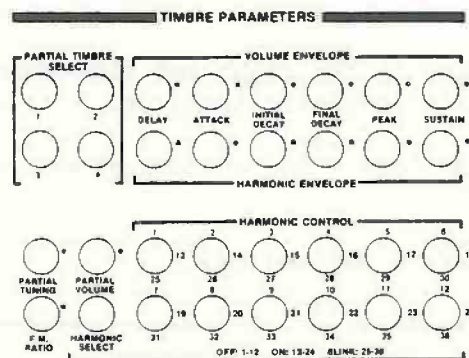
| | |
|---|----------|
| Timbre Programming and Keyboard Control | (Blue) |
| Memory Recorder | (Yellow) |
| Recall and Store | (Green) |

TIMBRE PROGRAMMING - BLUE BUTTONS

There are four different groups of buttons which are used to program a timbre and to define how it will sound and play on the keyboard.

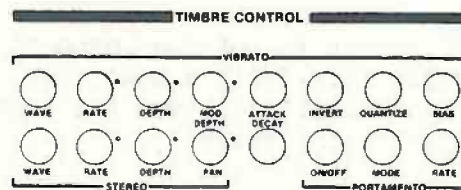
TIMBRE PARAMETERS

The buttons in the first panel are used along with the control knob to program the foundation of each timbre, that is, its overall volume and its waveform as well as any volume and harmonic structure changes that you wish to occur during the note. These parameters may be used to set up timbres that have very complex volume and/or harmonic envelopes.



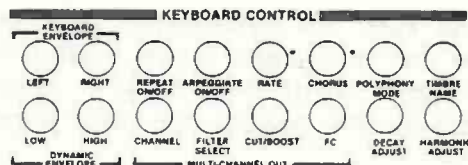
TIMBRE CONTROL

You use the knob and the buttons in the fifth panel to enrich the timbre: to add vibrato, stereo, amplitude modulation, and portamento.



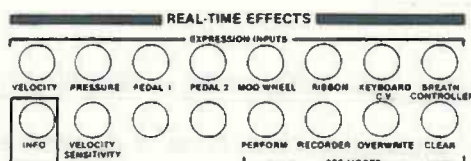
KEYBOARD CONTROL

You use the buttons in the lower fourth panel to add special keyboard effects to a timbre, such as automatic arpeggiation or chorus. You can also limit parts of the timbre to different regions on the keyboard.



REAL-TIME EFFECTS

And finally, in the lower fifth panel are buttons that allow you to patch different expression input devices (such as the keys themselves, the pedals, mod wheel, ribbon controller, and breath controller) to any of the timbre parameters that are marked with white dots. For example, if you patch "velocity" to "volume," the volume will change with the strength of your attacks.

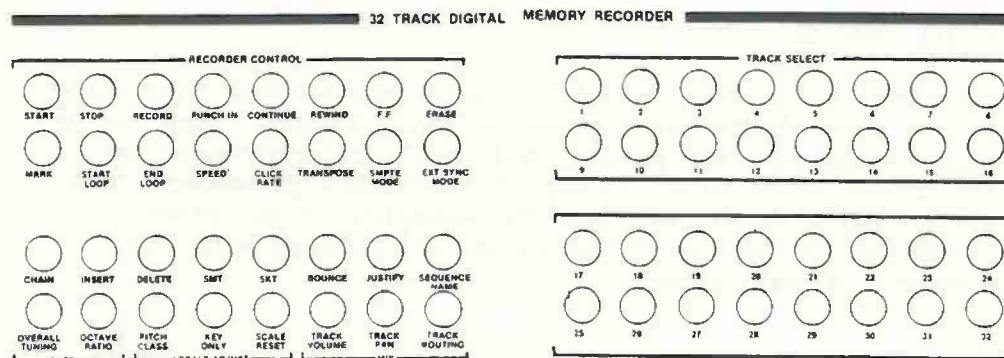


MEMORY RECORDER - YELLOW BUTTONS

The second and third panels are used to operate the the Synclavier (R) 32-track digital memory recorder. Depending on the amount of memory and the number of voices in your system, you can record and play back sequences with up to 100,000 notes and up to 32 different sounds. The second panel is used to select functions; the third panel is used to select tracks.

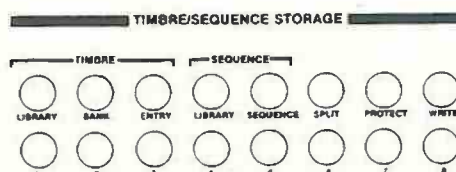
These two panels of buttons turn the Synclavier (R) into a complete recording studio. Precise and noiseless loops, independent speed and transpose changes, synchronization of recording or playback to SMPTE or to any external sync pulse, and mixing are only some of the possibilities.

The bottom row in panel two also contains buttons for special tuning functions that can be used to retune the keyboard, as well as the playback from the memory recorder.



RECALLING AND STORING TIMBRES AND SEQUENCES - GREEN BUTTONS

When you want to recall a preset timbre from a diskette or store a new timbre or recall or store a sequence, you use the buttons in the upper fourth panel. You will be able to access any storage device connected to your system and access several different subcatalogs on the Winchester as well. You can also "write protect" a timbre or sequence so that you don't accidentally overwrite it.



The rest of this manual will show you how to use the buttons and the knob.

RECALLING TIMBRES FROM THE SYSTEM DISKETTE

There are 16 preprogrammed timbres stored on the Synclavier (R) system diskette, and many others on the timbre diskettes. These timbres are ready for immediate recall at any time and will always sound exactly the same.

Timbres are stored on the diskettes in banks. There can be up to eight banks on each diskette and up to eight timbres (or entries) in each bank.

The 16 timbres on the system diskette are organized into two banks with eight timbres in each bank:

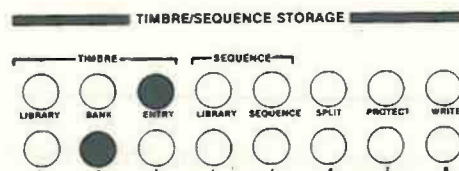
| Entry | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|--------|------------|-------------|--------------|-----------|-----------|------------|-----------|------------------|
| Bank 1 | SINE WAVE | CHURCH BELL | GIRLS' CHOIR | STRING #1 | STRING #2 | OBOE | WOOD WIND | RESYNTH. TRUMPET |
| Bank 2 | PERCUSSION | CALIMBA | BELL | VIBES | CLAVINET | 3 PARTIALS | BASS | "SYD" |

All eight timbre entries in Timbre Bank 1 are automatically placed in computer memory when you first load the Synclavier (R) operating system. The first timbre entry in that bank is placed on the keyboard. This timbre is a simple sine wave.

The numbered buttons under TIMBRE/SEQUENCE STORAGE are used to place a different timbre on the keyboard and to recall different banks of timbres to computer memory. These numbered buttons are also used to store timbre entries and entire banks, as well as to recall and store memory recorder sequences. The particular function of the numbered buttons is determined by the buttons in the top row. Storing timbre entries and banks and recalling and storing sequences is covered later. You will now learn how to recall timbre entries and banks.

Recalling a New Timbre

The ENTRY button in the top row should now be lit (if it isn't press the button to light it). This means that the entry select function has been assigned to the the numbered buttons below; they may now be used to bring to the keyboard any timbre in the bank currently in memory (Bank 1). Try pressing button 2 to bring the second timbre in Bank 1 to the keyboard.



When you press a key, it should sound like a church bell. Recalling most timbres takes place instantly, so you can change timbres easily in mid-performance.

Now look at the display window where you will see information about the new timbre.



1-1-2 4V OF

CHURCH BELL

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The numbers 1-1-2 make up the timbre identification number. The first 1 is the library* number, the second 1 is the bank number, and the 2 is the entry number. Note: In this manual we refer to any timbre on the system diskette as an Instruction Timbre to distinguish them from the timbres on the timbre diskettes. Thus, we call this timbre Instruction Timbre 1-1-2.

The expressions 4V OF show the number of voices and frames in the timbre. The voices are the number of synthesizer channels required to play a single note in that timbre. Some sounds require only one voice. Other more complex sounds require four, eight, or even sixteen voices. Frames are the number of spliced-in waveforms in a timbre. Both voices and frames are explained further in the next section. In general, the more voices and the more frames, the richer the sound.

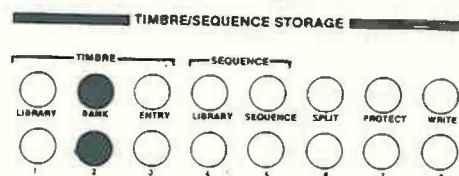
The word CHURCH BELL is the timbre name. The timbres mentioned in this manual have all been given names. You will be able to use the timbre name function to assign names to the other preset timbres and to your own timbres.

Now, try recalling the other timbres in Bank 1 by pressing the numbered buttons.

* The library number will always be "1" in this initial release of the software. In later releases, the library number will indicate the disk drive or Winchester location from which you have recalled the timbre.

Recalling a New Bank

To load a different bank of timbres into computer memory, press the BANK button under TIMBRE. This assigns the bank select function to the numbered buttons. Note that the ENTRY button becomes unlit as the BANK button lights up. You will also note that button 1 becomes lit. This shows you that Bank 1 is currently in memory. Now press button 2 to load a bank of eight different timbres. The loading process takes the computer slightly more than a second.



Loading a different bank does not change the keyboard timbre. To activate one of the timbres in the new bank, you must press the ENTRY button and then a numbered button. Try pressing ENTRY and then button 1 to recall Instruction Timbre 1-2-1. The keyboard will become a percussive instrument.

Now turn the page for instructions on how to play the different timbres in Bank 1 and Bank 2.

DIFFERENT KEYBOARD EFFECTS

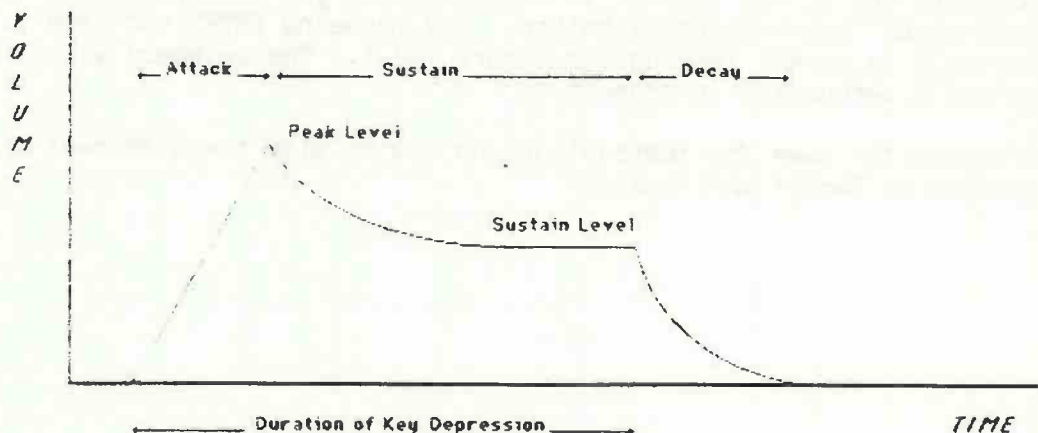
When you recall a timbre and play with it on the keyboard, what you hear is a product of both the characteristic sound of the timbre and the way you play it.

Some timbres are most effective when played rapidly, others require long sustained notes to achieve their full effect. Some timbres sound better played monophonically, others produce good chorus effects. And with some timbres, only a narrow range of keys will produce their characteristic sound.

Each timbre is programmed with its own volume envelope; that is, the shape of its sound over a period of time.

There are three basic time segments:

- the attack, or time it takes for the note to reach its peak volume;
- the sustain, or the time from the end of the attack to the moment you release the key;
- and the decay, or the time it takes for the sound to fade away after you release the key.



THE VOLUME ENVELOPE

A timbre may also have a harmonic envelope in which the same basic time segments are programmed for frequency modulation. Both kinds of envelopes are discussed in detail in the tabbed section, "Timbre Design."

How each element is programmed determines how a timbre will sound under different keyboard conditions. As you recall timbres, you will need to experiment with different keyboard techniques. Following are some of the things you may want to look for.

Sustaining Timbres

A sustaining timbre is one in which the sustain segment has been programmed so that the note will sound so long as you hold the key down. When you lift the key, the decay begins.

Sustaining Timbres

1. Recall Instruction Timbre 1-1-4.

2. Play a single note and hold it.

The sound gets brighter as you hold down the key because the harmonic envelope has been programmed to provide frequency modulation during the sustain segment. The rich string sound of the note continues so long as the key is held down.

3. Release the key.

When you release the key, the note fades away slowly, since it has a long programmed decay.

4. Play a series of rapid staccato notes.

When you play staccato, only the attack sounds. Since the attack volume is set at zero, the sounds cannot be loud. Furthermore, the string quality is lost, since the programming that recreates the string sound is in the sustain segment.

5. Now play the keyboard as if you were bowing a violin. The best string quality of the timbre comes out when you "think" like a violinist.

6. Recall Instruction Timbre 1-1-5.

Some of the sound components of this timbre are tuned an octave lower than others so that it sounds like several stringed instruments playing together.

7. Play a single note and hold it.

This timbre also has a rich string sound when you hold the note down. The sound is fuller than the previous timbre, because several of its components have been doubled.

8. Release the key.

The sound cuts off as soon as you lift your finger because the programmed decay is very short.

Non-sustaining Timbres

A non-sustaining timbre is one in which the volume of the sustain segment is set at zero. The sound of the timbre is contained entirely in the attack and the decay segments. When you play a non-sustaining timbre, the sound will cut off even if you leave your finger on the key. If the decay segment is also very short, a plucked sound will result, as in a plucked guitar sound.

Non-sustaining Timbres

1. Recall Instruction Timbre 1-2-1.

This timbre is programmed to have no volume during the sustain segment and a very short decay time. All the sound comes from the attack segment.

2. Play a note and hold it down.

The sound cuts off almost instantly, no matter how long you hold the key.

3. Play a series of very rapid notes.

There is no overlapping sound, even when you play extremely fast.

4. Recall Instruction Timbre 1-2-3.

This bell-like timbre has no sustain segment but does have a very long decay segment.

5. Play a single note and hold it.

You will hear only the attack.

6. Now play a series of notes very rapidly.

The quicker you play, the longer the sound rings out. The long final decay is heard only when you release the key during the attack segment.

Number of Voices

When you recall a timbre, the display window prints a voice number. This number represents the total number of synthesizer voices required to play that timbre. The number is important, especially when you are playing with sustaining timbres, as it determines the number of notes you can play simultaneously.

For example, if you have a 16-voice system and you have recalled a timbre with 4V in the display window, then only four different notes can sound at any given time because each note you play will use up four voices. If you are holding a four-note chord and then play another note, the fifth note will not be heard. Furthermore, "bars" will appear in the display window telling you that the synthesizers cannot play the note.

Running Out of Voices

1. Recall Instruction Timbre 1-1-5 again.

The 8V in the display window tells you that this timbre uses eight voices.

2. Play a series of notes slowly, holding each key long enough to hear the richness of the timbre.
3. Now play an arpeggiated chord, holding down each note while adding successive ones.

If you have a 16-voice system, bars will appear in the display window as you try to add the third note. If you have a 32-voice system, you will be able to play four notes together before you run out of voices.

Keyboard Polyphony

There is a related function that can further limit the number of notes you can play simultaneously. This is keyboard polyphony. That is, a timbre may be programmed so that only one note at a time can play, regardless of the number of synthesizer voices in your system.

A Monophonic Timbre

1. Recall Instruction Timbre 1-1-6.

The 4V in the display window tells you this timbre uses four voices. If you have a 16-voice synthesizer, you would expect to be able to play four notes simultaneously before running out of voices.

2. Play a single note and hold it down.

The oboe-like timbre is a sustained timbre and you hear its full sound so long as you hold down the key.

3. Now play an arpeggio, holding down each note while adding new ones.

Notice that as each new note is added, the preceding one is cut off even though you are still holding down the key. This is because the timbre has been programmed to be monophonic.

4. Play a series of rapid runs and trills.

Notice how clean these notes sound with no overlapping decays.

Keyboard polyphony can be set for any number of simultaneous notes up to the total number of synthesizer voices in your system. For details, see the tabbed section, "Timbre Design."

Keyboard Range

Many timbres maintain their characteristic timbre only within a certain range on the keyboard. This is particularly true of timbres that have been resynthesized from acoustic sounds sampled with the Sample-to-Disk (tm) system.

Range

(Note that when you recall resynthesis timbres, it will take a little longer to access them.)

1. Recall Instruction Timbre 1-1-8.

This is a timbre created from a recorded note played by a trumpet.

2. Play a few notes in the treble range and then play up and down the keyboard.

Notice how the timbre sounds most like a trumpet in the octave and a half above middle C. It sounds like the lower brass instruments in the bass range but in the far upper range it no longer has the quality of a brass instrument.

3. Recall Instruction Timbre 1-2-8.

This is a resynthesis of the word "Syd" spoken by a tenor voice.

4. Try to find where it is most realistic. The human voice becomes totally transformed when you change the pitch very much.

Real-Time Effects

Some timbres are programmed for real-time effects. When you recall one of these timbres, one or more of the buttons under EXPRESSION INPUTS (REAL-TIME EFFECTS, Panel 5) will light up to let you know which real-time effect is part of the timbre.

Real-Time Effects

1. Recall Instruction Timbre 1-1-3. Both VELOCITY and PRESSURE buttons will light up.
2. Press VELOCITY. The PARTIAL VOLUME button, all four PARTIAL TIMBRE SELECT buttons, and the VOLUME ENVELOPE PEAK and SUSTAIN buttons will all light up.

You will learn about real-time patching further on in this Introduction. Essentially, the buttons are telling you that the velocity expression input is patched to volume and thus, the faster you play the keys, the louder the sound will be.

3. Press PRESSURE. The same buttons will light up, meaning that after you depress a key, you can apply pressure to make the sound louder.
4. Play a series of rapid notes and then a series of slow ones. When you play slowly, the sounds will be very soft; as you play faster, the sound is louder.
5. Play a single note or a chord and apply pressure after the key is down. The harder you press, the more the sound swells.
6. Play middle C and apply pressure. When you press as hard as you can, the C below middle C will emerge as part of the sound. This is because the timbre is programmed for frequency modulation.

When you learn about FM in the tabbed section, "Timbre Design," you will learn that frequency modulation introduces additional harmonic components into the timbre, components that may even be below the fundamental frequency of the note played. Whether or not those extra harmonics are present in the timbre depends on how loud a note sounds.

In this timbre, the harmonic component that occurs below the fundamental is only present when the timbre is sounding at full volume.

RECALLING TIMBRES FROM TIMBRE DISKETTES

Now that you have learned a little about timbres, you will want to experiment with the timbres on the timbre diskettes. (See the Timbre Directory in the Appendix for a description of all the timbres.)

If you have one floppy disk drive, simply remove the system diskette from the disk drive and replace it with a timbre diskette. Do NOT press the LOAD button.* Then access the new timbres in the usual way with the BANK, ENTRY and numbered buttons.

If you have two floppy disk drives, you may leave the system diskette in the left-hand or MAIN drive and insert timbre diskettes in the right-hand or AUXILIARY drive. Then,

1. press BANK to assign the bank recall function to the numbered buttons;
2. press the LIBRARY button and hold it down while you press a numbered button in the bottom row;
3. press ENTRY to assign the timbre recall function to the numbered buttons;
4. press the LIBRARY button and hold it down while you press a numbered button in the bottom row.

You must press LIBRARY** every time you want to read a new bank or timbre off the diskette in the AUXILIARY drive. If you don't, you will recall the bank and timbre from the system diskette. Furthermore, if you try to recall Banks 3 through 8, without pressing LIBRARY, the display window will say "TIMBRE BANK DOES NOT EXIST," since the system diskette only contains two banks.

*You should never press the LOAD button unless the system diskette is in the drive.

**In the later releases of the software, the LIBRARY button will allow you to access a variety of storage devices, including the Winchester disk. With this software release, however, you cannot access timbres on the Winchester disk if you have loaded the Real-Time Performance operating system.

Many of the timbres on your timbre diskettes are resynthesis timbres. These special timbres are authentic recreations of actual sounds recorded and analyzed by the Sample-to-Disk (tm) system and then converted into Synclavier (R) timbres.

Resynthesis timbres contain spliced-in waveforms which cause them to take up much more storage space than do other timbres. Therefore, while all the timbre diskettes have eight banks of timbres, there are often fewer than eight timbres per bank, with the remaining timbre entries empty. When you recall an empty entry, the display window will read 0 voices and 0 frames and no sound will be heard on the keyboard.

Now you know how to recall and play the Synclavier (R) library of sounds. The following sections will show you more about what goes into these sounds, how to modify them, and how to record them.

WHAT'S IN A TIMBRE?

PARTIAL TIMBRES

You have listened to a wide range of Synclavier (R) timbres. Before going further, you should understand a little about how a timbre is constructed.

Each Synclavier (R) timbre consists of from one to four individual sound components called partial timbres. Each partial timbre is programmed separately and has its own waveform, overall volume level, volume envelope, frequency modulation, tuning, vibrato, and so on. A timbre can be constructed from very similar partial timbres or from very different ones as you will see in the two exercises below.

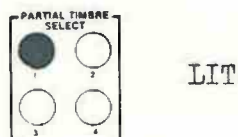
One synthesizer voice is required to produce the sound of each partial timbre in a timbre.

The partial timbres in a timbre can also be chorused. Here each partial timbre is played by two synthesizer voices. The first plays the partial timbre at the tuning set for the partial and the second plays the partial timbre at a programmed interval above or below. The chorus effect makes for very full sounds, but it uses twice as many voices.

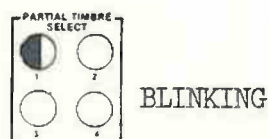
Using the PARTIAL TIMBRE SELECT Buttons

The PARTIAL TIMBRE SELECT buttons on the far left of the button panel are used to select a partial timbre for programming or for soloing it on the keyboard.

Normally, you hear all partial timbres in a timbre when you play a note. In this case, one or more of the PARTIAL TIMBRE SELECT buttons will be lit.



If you want to hear the sound of just one partial timbre and not the others, press the appropriate PARTIAL TIMBRE SELECT button and make it blink.



Whenever a PARTIAL TIMBRE SELECT button is blinking, only that partial timbre will be heard when you press a key on the keyboard. If more than one PARTIAL TIMBRE SELECT button are blinking, all those that are selected will be heard.

When a PARTIAL TIMBRE SELECT button is lit or blinking, the related partial timbre may be programmed with the control knob and timbre parameter buttons. This is described later in "Using the Knob and Buttons to Modify a Timbre."

When you press a lit PARTIAL TIMBRE SELECT button, it will start blinking. When you press a blinking PARTIAL TIMBRE SELECT button, it will stop blinking and become lit. When you press a different PARTIAL TIMBRE SELECT button, it will assume the same state as the previous button which will simultaneously become unlit. To make more than one button blink or become lit, press the desired buttons simultaneously.

Finally, when you recall a new timbre, you will not change the state of the PARTIAL TIMBRE SELECT buttons. At all times at least one PARTIAL TIMBRE SELECT button will be either lit or blinking.

In the next two exercises you will practice pressing the PARTIAL TIMBRE SELECT buttons to see how they operate. More importantly, you will learn a little about how a timbre can be constructed from separate sounds.

Before continuing with the exercises, replace the system diskette in the disk drive. You will be using the Instruction Timbres throughout the rest of this manual.

Accessing Partial Timbres

1. Recall Instruction Timbre 1-2-6.

Button 1 under PARTIAL TIMBRE SELECT should be lit.

When you press a key on the keyboard, you will hear a complex sound consisting of three partial timbres.

2. Press Button 1.

Button 1 will start blinking. When you press a key on the keyboard, you will hear only the piano-like sound of Partial Timbre 1.

3. Press Button 2.

Button 2 will start blinking; button 1 will become unlit.

4. Press a key and you will hear only Partial Timbre 2, a sound more like a harpsichord.

5. Press Button 3 to solo Partial Timbre 3.

When you press a key, you will hear an octave trill.

6. Press Button 4.

This time, when you press a key on the keyboard, there will be no sound and "bars" will appear in the display window. Partial Timbre 4 cannot be played because its volume has been set at zero. Any time a partial timbre cannot be played these bars will occur.

7. Now press Button 1 twice.

Button 1 should be lit. When you press a key on the keyboard, you will hear the complete timbre again.

A Partial Timbre with Chorus

1. Now recall Instruction Timbre 1-1-5, the orchestral string sound you tried earlier. Note that it says 8V in the display window; eight voices are required since this timbre has four partial timbres with chorus.

2. Solo each partial timbre and listen to the tuning.

Partial Timbre 1 is tuned to 440, Partial Timbre 2 is tuned to 880, Partial Timbre 3 is tuned a little flat, and Partial Timbre 4 is tuned a little sharp. Furthermore, chorusing synthesizers for each of these partial timbres are tuned to sound an octave below.

3. Listen also to the vibrato. Partial Timbre 3 has been assigned triangle vibrato. The others all have sine wave vibrato.
4. Note also that Partial Timbre 4 has no first, second, or third harmonic. This accentuates the upper harmonics in the sound and adds to the string-like quality.

TIMBRE FRAMES

Most of the Instruction Timbres and many of the preset timbres on the timbre diskettes have partial timbres with single waveforms which do not change during the note. These waveforms have all been programmed by specifying the relative amplitudes of up to 24 harmonics.

In Instruction Timbre 1-1-8 and 1-2-8, as well as all the resynthesis timbres on the timbre diskettes, each partial timbre is constructed from a chain of waveforms or timbre frames. To create these sounds, acoustic or electronic sounds were recorded by the Synclavier (R) Sample-to-Disk (tm) system and then analyzed for the changes in harmonics that occurred during the note. The sounds were then turned into Synclavier (R) timbres with a series of timbre frames. As you have heard, the results are very realistic.

Using the PARTIAL TIMBRE SELECT BUTTONS for Frames

The PARTIAL TIMBRE SELECT buttons are used to add a frame to a partial timbre or to remove a frame, to select a frame for programming, or to solo a frame on the keyboard.

To access a timbre frame, you hold down the desired PARTIAL TIMBRE SELECT button and then use the control knob to dial the desired frame. Spliced-in frames are numbered starting with 1. Whenever you recall a timbre or solo a partial, Frame 0 (which represents the initial waveform and the overall volume envelope) will be selected.



FRAME 1

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HOLD BUTTON

Once you have dialed a frame, you hold the PARTIAL TIMBRE SELECT button and press a key to hear the sound of the frame.

Accessing Timbre Frames

1. Recall Instruction Timbre 1-1-8, the resynthesized trumpet.

You will see from the display window that this timbre contains 14 timbre frames.

2. Press and hold down button 1 under PARTIAL TIMBRE SELECT.

The words

FRAME 0

will appear in the display window. You have now soloed Frame 0, the frame which contains the attack of the partial timbre.

3. While continuing to hold down button 1, press a key on the keyboard. You will hear only the attack of the partial timbre.

4. Continue to hold down button 1 and turn the control knob until

FRAME 1

appears in the window. You have now soloed Frame 1, the first timbre frame of the partial.

5. Continue to hold down button 1 while you play a note on the keyboard. The attack in the original waveform will sound first and then begin to splice to the first timbre frame. The amplitude of this waveform will rise until it reaches its programmed peak and will stay there until you release the key.
6. Step through the frames, soloing each one. You will hear how the sound brightens, frame by frame, during the attack.

Programming frames is covered in the tabbed section, "Timbre Design."

CHANGING A SOUND

USING THE KNOB AND BUTTONS

In this section you will learn how to make changes in a timbre. The timbre you will be changing is the sine wave of Instruction Timbre 1-1-1. You are going to add vibrato to this sound and then vary the depth and rate of the vibrato.

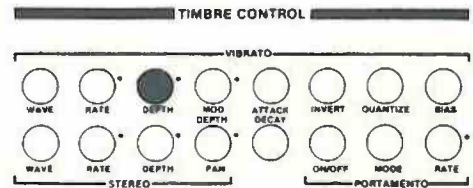
You will use the VIBRATO DEPTH and RATE buttons along with the control knob to set up a new timbre definition that will be stored in memory. First you will use the DEPTH button to change the depth of the vibrato. Then you will use the RATE button to change the speed of the vibrato. As you make the changes, you will see them in the display window. When you play the keyboard, the modified timbre will be heard on every note you play.

VIBRATO DEPTH



0.00 SEMITONES

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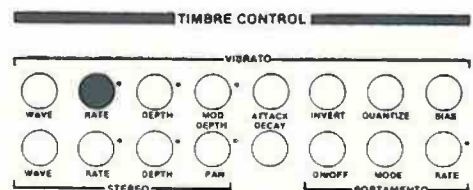


VIBRATO RATE



6.00 HERTZ

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Changing Vibrato Depth

1. Recall Instruction Timbre 1-1-1, the sine wave.
2. Make sure Button 1 under PARTIAL TIMBRE SELECT is lit, since you are going to be programming Partial Timbre 1.
3. Press the VIBRATO DEPTH button on the fifth panel.

You have just assigned the vibrato depth function to the control knob.

The DEPTH button will light up and

0.00 SEMITONES

will appear in the display window.

When you press a key on the keyboard, you will hear a sound with no vibrato, since it has zero depth.

4. Turn the control knob slowly to the right while pressing a key on the keyboard.

Vibrato depth will slowly increase as the numbers increase in the display window. A setting of 1.00 will create a fluctuation in pitch of one semitone in either direction from the pitch of the note played on the keyboard. The maximum vibrato depth is 24.00 semitones, a sweep from two octaves above to two octaves below the keyboard pitch.

When you finally release the control knob, the setting in the display window will be stored in the computer memory.

Changing Vibrato Rate

1. Now press the RATE button under VIBRATO.

The DEPTH button will go out and the RATE button will light up. A setting of

6.00 HERTZ

will appear in the digital display window. This is the current vibrato rate.

This time, when you turn the control knob, you will change the vibrato rate rather than the depth. The last vibrato depth setting that you established in the window will remain in effect.

2. Turn the control knob to the left.

The vibrato rate will decrease. When the setting in the window is .00, you will hear no vibrato at all. To hear vibrato, then, you must have non-zero settings for both the depth and the rate.

3. Now turn the knob to the right.

You can dial any vibrato rate up to 50.00 hertz. The last setting that you dial in will be the one stored in the memory recorder.

4. Now play some notes on the keyboard. The sound that you hear will be a sine wave modified by vibrato. The rate and depth of vibrato will be those values assigned by you.

The timbre has only been modified in computer memory. The original Instruction Timbre 1-1-1 still exists without any vibrato on your system diskette.

You have just learned the basics of timbre programming on the Synclavier (R). You simply press the button for the aspect of the sound you wish to change and turn the control knob. The keyboard sound will instantly reflect the new setting. Each change is memorized by the computer as you move from function to function constructing the desired sound. When you play the keyboard, every note will sound in the modified timbre.

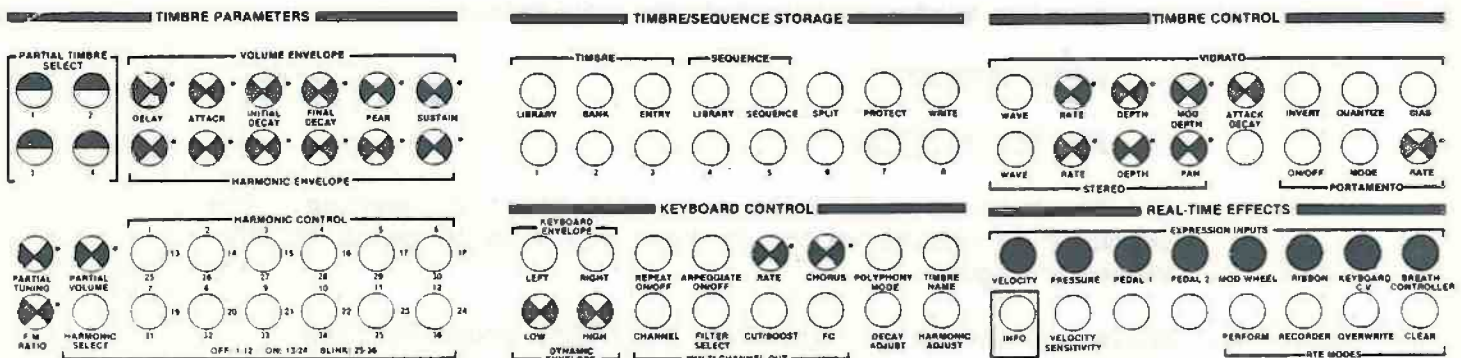
In the tabbed section, "Timbre Design," you will learn, in detail, how to use the control knob to construct a timbre from periodic waveforms, volume and harmonic envelopes, and to make other musical modifications. You will also learn how to store your own timbre constructions on diskette for permanent use.

USING VELOCITY AND PRESSURE

The real time changes you can make while you play are virtually endless. You can make many of the same kinds of timbre modifications that are possible using the control knob and knob buttons. The difference is that when you use the velocity and pressure inputs, you will be changing the characteristic sound of the timbre on a note by note basis. Each note that you play will have a timbre slightly different from the last, depending on how quick your attack is or how much pressure you apply to the key after the attack. None of these changes will be automatically stored in memory the way timbre modifications done with the control knob are. (They are, however, placed in memory when you use the memory recorder.)

To use the keyboard for real time effects, you "patch" one or more expression input devices, such as velocity or pressure, to a timbre parameter, such as partial volume, as well as to the partial timbre(s) you want to effect.

In effect, you are making a three-way patch from the **EXPRESSION INPUT** button or buttons to the timbre parameter buttons with the white dots and the **PARTIAL TIMBRE SELECT** button or buttons.



THE PARTS OF PATCH

- ☐ EXPRESSION INPUTS
- ☒ PARTIAL TIMBRES
- ☒ CHANGING PARAMETERS

In the first exercise you are going to patch the velocity input to the volume of a timbre.

Patching Velocity to Volume

1. Recall Instruction Timbre 1-1-7.

2. Press the PARTIAL VOLUME button.

In the display window you will see

100.0

This means that the maximum volume possible is 100 percent.

3. Press the VELOCITY button and hold it down.

The VELOCITY button will light up and so will all four buttons under PARTIAL TIMBRE SELECT. All real time effects are by default patched to all four partial timbres.

The display window will print the following:

PRESS BUTTONS

FOR RTE PATCHING

All the buttons with white dots will start flickering. The computer is asking which of these you wish to patch to the velocity input.

4. While continuing to hold down VELOCITY, press PARTIAL VOLUME.

As you press it, it will light up, as will the PEAK and SUSTAIN buttons under VOLUME ENVELOPE. When you release the VELOCITY button, the PARTIAL VOLUME, PEAK and SUSTAIN buttons will go out. The VELOCITY button will remain lit.

5. Now play some notes on the keyboard, varying the speed of your attack.

Notice how you can control the volume of the notes by the speed of your attack.

In this next exercise, you will add pressure as a controlling device. This will make it possible to begin a note softly by using a slow attack and then have it swell by applying more pressure to the key while you hold it down.

Adding Pressure

1. Press PRESSURE and hold it down while you press PARTIAL VOLUME.

Now both velocity and pressure are attached to the volume of the timbre. Both buttons will be lit.

2. Play a note with a slow attack and then press the key down hard.

The note will begin softly and then swell as you apply more pressure.

3. Play a series of notes, varying both your attacks and the amount of pressure you apply after the attack.

As you hear, it takes some practice to exercise this kind of keyboard control.

The next exercise will add controlling the brightness of the timbre with the speed of your attack. Instruction Timbre 1-1-7, the timbre currently on the keyboard, consists of a sine wave that has been frequency modulated by another sine wave to create overtones. (Frequency modulation is discussed in detail in the tabbed section, "Timbre Design.")

To control the amount of frequency modulation, you will be patching the velocity input to the sustain segment of the harmonic envelope.

Patching Velocity to Frequency Modulation

1. Press the HARMONIC ENVELOPE SUSTAIN button. You should see

30 FM SUSTAIN

in the display window. This number sets the depth of modulation on an arbitrary scale of 0 (no FM) to 1000 (maximum FM).

2. Dial in a setting of 180 with the control knob. This sets the maximum limit for the depth of modulation.

3. Now patch the velocity input to the sustain function by pressing and holding down the VELOCITY button while pressing the SUSTAIN button. The SUSTAIN button will light up, along with the previously patched PARTIAL VOLUME and VOLUME ENVELOPE PEAK and SUSTAIN buttons. They will all go out when you release the VELOCITY button.

4. Play some notes on the keyboard, varying the speed of your attack from very slow to very fast. With your slowest attack, you will hear only the sine wave. As you increase your attack speed, you will hear the timbre become brighter as more and more overtones are added by the frequency modulation.

In the tabbed section, "Keyboard Control and Real Time Effects," you will learn how to use the pedals, the ribbon controller, the mod wheel and so forth in much the same way to vary many other aspects of a sound during performance.

THE MEMORY RECORDER

HOW IT WORKS

The Synclavier (R) 32-track memory recorder* combines the functions of a tape recorder and sound mixer to create a complete sound studio for recording, editing and producing music.

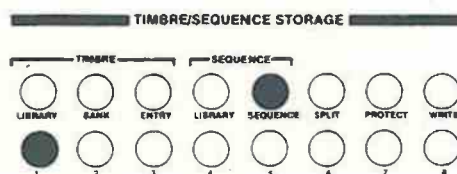
Some functions of the memory recorder work similarly to their counterparts on a tape recorder. Other functions have their equivalents on a sound mixer. Other functions are unique to the Synclavier (R).

When you edit sounds on the Synclavier (R) memory recorder, you can remove, add in or change a single note on an already recorded track. You can loop a single track or all tracks, the entire composition or part of it. You can speed up or slow down a sequence without changing the pitch. Notes recorded slightly ahead of or behind the beat can be justified to start precisely on the beat in playback. Tracks that were recorded using one timbre can have another timbre substituted.

In effect, the Synclavier (R) 32-track memory recorder works like a word processor for sounds. Just as the words of a text can be written, edited, rearranged and formatted for production by a word processor, saving thousands of hours of retyping and typesetting, so music recorded in the Synclavier (R) memory recorder can move quickly and without noise from raw sounds to polished production.

Recalling Sequences

There are sample sequences in the sequence storage areas on the operating system diskette. To recall one of these sequences, you use the buttons under TIMBRE/SEQUENCE STORAGE. Press the SEQUENCE button and then press the numbered button for the desired sequence storage area.



Playback Functions

The playback functions on the Synclavier (R) memory recorder are similar to those on a tape recorder, with some additional features. The playback buttons are located in the top row under RECORDER CONTROL.

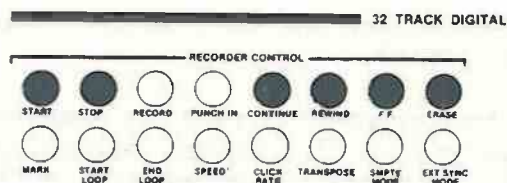
There are three different ways to play back a sequence. To start a

*As of this release, only 16 tracks are available.

sequence playing from the first beat of the piece, press the START button. To start a sequence playing from the first recorded sound of a piece, press START twice. To start a piece from wherever you last stopped it, press CONTINUE. To stop a sequence, press STOP.

The fast forward and rewind functions are similar to those on a tape recorder. You press F.F. to move forward quickly in the sequence and REWIND to move rapidly backward. The sound is audible in either case.

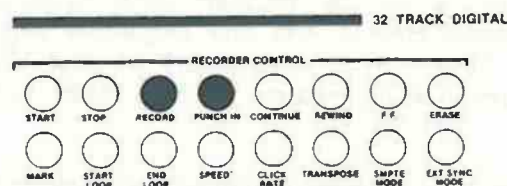
To erase notes in the memory recorder, press the ERASE button twice. Entire sequences or individual tracks can be erased.



Recording Sequences

All notes are memorized just as you play them on the keyboard. You can record up to 32 different timbres on 32 different tracks. When you play them back, you can listen to all tracks together or any combination of tracks.

Two buttons, both in the top row under RECORDER CONTROL, are used to record sequences. The RECORD button automatically selects a new track so that any previously recorded notes remain in memory on the track they were recorded on. The PUNCH IN button is used to record new notes over previously recorded notes, erasing the old notes as the new ones are placed in memory.



A sequence recorded and stored in the memory recorder, however, is only a temporary working copy. It will be lost when you recall a different sequence from diskette or when you turn off the computer. For a permanent copy of any sequence, you will want to store the sequence on diskette. Storing sequences is fully described in the tabbed section, "Memory Recorder."

PLAYING BACK AND CHANGING A RECORDED SEQUENCE

The following exercises will show you how to recall a sequence, play it back, listen to each track separately and make timbre modifications on different tracks.

Recalling a Sequence and Playing It Back

1. Place the system diskette back in the disk drive. This diskette has a Synclavier (R) arrangement of "Scarborough Fair" stored on it.
2. Press the SEQUENCE button and then Button 1 under TIMBRE/SEQUENCE STORAGE.

This instructs the computer to read the sequence in the sequence storage area on the system diskette and to place it in the memory recorder. This sequence is "Scarborough Fair."

The number appearing in the display window indicates the number of notes you could add to this sequence if you wished to. The number depends on the amount of memory in your system.

The ENDLOOP button in the second panel will light up. That means the sequence has an overall loop on all tracks in the sequence.

3. Press START once.

The beats of the digital metronome will appear in the window. The tempo of "Scarborough Fair" is set at 120 beats per minute, with the quarter note equalling one beat. The time signature is 3/4 and the sequence begins with a two-bar rest. There is a loop point at bar 17, at which point the sequence will return to the first note and start over.

Notice that the beats in the display window count up to the beat number 57 (the loop point) and then return to beat 7 (the beat number of the first note in the sequence, after the six-beat rest).

4. While the sequence loops, press STOP.

The memory recorder will stop playing.

Arranged by Bill Keenan

Scarborough Fair

English Folk Song

mp

mp

mp

5

9

14

Playing Back From Different Points in a Sequence

1. Press START.

No matter where you stopped the sequence at the end of the previous exercise, the sequence will start from the first beat.

2. At any point in the loop, press STOP.
3. Now, press CONTINUE.

The sequence will be played from the point where you pressed STOP, rather than from the beginning.

4. Press STOP.
5. Now press START twice.

The recorder will skip over the two-bar rest at the beginning of the sequence and begin on the first note. The metronome in the display window will start counting from beat number 7.

6. Press STOP at any point.

Searching for a Particular Point in a Sequence

You are going to locate the first note in Bar 9 (beat 33). Looking for a particular note will be easier if you use the digital metronome. The number in the display window will tell you what beat you stopped at when you pressed STOP in the last exercise.

- If you stopped before beat 33 (the beat of the first note in Bar 9), press F. F. and then press STOP when 33 appears in the display window.
- If you stopped after beat 33, press REWIND and then STOP when 33 appears in the display window.

To "solo" means to isolate one or more tracks from the overall group of 32 tracks. Soloed tracks can be listened to individually or in any combination.

"Scarborough Fair" has been recorded on Tracks 1 through 4 with four different timbres. All notes on a track have the same timbre.

Soloing Tracks

1. Press START.
2. While the sequence is looping, press Button 1 under TRACK SELECT in the third panel.

Button 1 will start blinking. Only the notes recorded on Track 1 will be audible.

3. Press Button 2.

Button 2 will start blinking; Button 1 will stop blinking and will remain lit.

Now you will hear the notes recorded on Tracks 1 and 2.

(The blinking and lit states of Button 1 and Button 2 have to do with recording. In playback, the lit or blinking state means the same thing.)

4. Press Button 1 again.

Button 1 will go out and you will hear only the notes on Track 2.

5. Press Button 2 again.

All TRACK buttons will be out. You will hear all tracks.

6. Try soloing Track 3 and Track 4.

To summarize, when all TRACK SELECT lights are out, all tracks will be heard when the sequence is played. When any or several TRACK buttons are lit or blinking, only the selected tracks will be heard. To "unsolo" a track, press the TRACK SELECT button a second time.

In the following exercise you will be replacing the timbre on Track 1 with a new timbre. Do the exercise while the sequence continues to loop.

Substituting Timbres

1. Press the BANK button and then Button 1 in the TIMBRE/SEQUENCE STORAGE panel.

This loads Timbre Bank 1, bank containing the timbre you are going to substitute, into memory. While the bank is being loaded into the Synclavier (R) computer, the recorder will pause.

2. Press the ENTRY button in the TIMBRE/SEQUENCE STORAGE panel but do not press a number button.
3. Press the SMT button in the second panel.

The SMT (select memory timbre) button will light up and all 32 TRACK SELECT buttons will start blinking. The memory recorder is asking you which track you wish to change.

4. Press Button 1 under TRACK SELECT.

The 32 TRACK SELECT buttons will continue to blink. The SKT (Select Keyboard Timbre) and all the numbered buttons under TIMBRE/SEQUENCE STORAGE will start to blink. The recorder is asking you whether you want to change to

- a timbre used on another track (TRACK SELECT buttons);
- the timbre active on the keyboard (SKT button);
- a timbre stored in the timbre bank in computer memory (TIMBRE/SEQUENCE STORAGE buttons).

In this case, you are going to change to a timbre in the bank.

5. Select Timbre Entry 6 by pressing Button 6.

The recorder will pause for a second and then resume with the notes on Track 1 played with Instruction Timbre 1-1-6 (the oboe).

6. Try substituting other timbres on this and other tracks in the sequence. You can substitute timbres either when the recorder is playing or when it is stopped.

The timbres that you substitute are held only in the memory recorder. The permanent copy of "Scarborough Fair" stored on the diskette remains unaffected.

RECORDING A SEQUENCE

In the next group of exercises you will record a sequence on several tracks, bounce notes from one track to another, establish an overall loop, and transpose the sequence.

Recording the First Track

[Instruction Timbre 1-1-7 with the patched-in real-time effects should still be on the keyboard. If it isn't, recall it.]

1. Press ERASE twice.

The temporary copy of "Scarborough Fair" in the memory recorder is erased. The permanent copy on the diskette has not been erased.

2. Press RECORD and play some notes.

The START and RECORD buttons will light up. Button 1 under TRACK SELECT will start blinking. The computer has automatically selected the first empty track in the recorder, in this case, Track 1, on which to record your notes.

3. When you're finished with your sequence of notes, press STOP.

Your notes have now been recorded on Track 1 of the memory recorder.

The number in the display window will indicate the number of notes that you may add to your sequence before you exceed the memory capacity of the computer.

4. Press START once to hear the sequence from the first beat or twice to hear it from the first note you played.

The beats will start counting in the window again. You will hear that everything you played on the keyboard, including the changes in volume and frequency modulation, has been memorized in relation to the beat of the digital metronome.

5. When your sequence has finished playing, press STOP.

To overdub means to add more notes to a sequence without erasing recorded notes. In this exercise, you will record notes in the same timbre to the Track 2 and then bounce them to Track 1.

Overdubbing With the Same Timbre

1. Press RECORD.

The START and RECORD buttons will again light up. Button 2 under TRACK SELECT will start to blink. The notes recorded on Track 1 will start playing.

2. Play along with the recorded notes.

Your new notes will be recorded on Track 2.

3. When you're finished recording, press STOP.

The display window should display fewer notes.

4. Press START to play back both tracks.

5. If you want to improve the second track, you can erase it without erasing the first track. Press Button 2 so that it blinks. Then press ERASE twice and go through the recording process again.

6. When you have the second track the way you want it, press BOUNCE.

The BOUNCE button will light up along with all 32 track buttons. The recorder is asking you which track you want to bounce.

7. Press the TRACK 2 button and then the TRACK 1 button.

All the track lights and the BOUNCE light will go out. The notes on Track 2 have been merged with those on Track 1. Track 2 will be erased.

8. Solo each track to check this.

You could have achieved this same effect by recording the new notes on Track 1 to begin with. You would have done this by soloing Track 1 before recording. However, it is safer to record on a second track and then bounce it down.

Overdubbing With a New Timbre

1. Recall Instruction Timbre 1-2-5 to the keyboard. This clavinet timbre is a good accompaniment sound.
2. Press RECORD.

As before, the START and RECORD buttons will light up. The TRACK 2 button will start blinking. Track 1 will start playing.

3. Play along with the music recorded on Track 1.
4. When you're finished recording, press STOP.
5. Press START.

You will hear the notes on Track 1 and Track 2. Solo the tracks if you like.

NOTE: You cannot bounce this track down to Track 1 because it uses a different timbre. Only tracks using the same timbre can be bounced together.

When overdubbing, each new track you add uses up more voices. In these exercises, each note on the first track used one voice and each note on the second track used two. If you played chords on both tracks, you may have run out of voices as you recorded Track 2.

When you exceed the maximum number of voices in your system while recording, the notes are still placed in memory. You simply will not be able to hear all of them when you record and playback. When this happens, you will have to solo different tracks to hear the notes.

Establishing a Loop

1. Press START and, at some point in the sequence, press ENDLOOP.

The ENDLOOP button will light up and the recorder will instantly go back to the first note in the sequence and begin to play again. It will play until it reaches the loop point (the point in the sequence where you pressed ENDLOOP) and then return to the beginning again. Your sequence will loop continuously.

You can see the loop in the window. The beats will count up to the beat number of the loop point and then return to the beat number of the first note in the sequence.

2. Press STOP and then START.

You will see that the loop has been memorized. Your sequence will begin at the beginning, play to the loop point, and then start looping.

3. Now press ENDLOOP again.

The ENDLOOP button will go out and the recorder will play the sequence past the loop point. The loop is gone.

This exercise demonstrated an overall da capo loop. You can also loop individual tracks and loop back to a point in the middle of a sequence (dal segno). Furthermore, if you have trouble hitting the ENDLOOP button precisely on the beat, you can instruct the computer to align the loop point for you. Details are covered in the tabbed section, "Memory Recorder."

When the TRANSPOSE button on the second panel is lit, the keyboard is used, not to play notes, but to give directions for transposing the sequence.

Transposing a Sequence

[This exercise may be performed conveniently if you first place a loop on your sequence.]

1. Press TRANSPOSE while the sequence is looping.

The TRANSPOSE button will light up and stay lit.

2. Press E above middle C on the keyboard.

The sequence will be instantly transposed up a major third. The Synclavier (R) computer calculates the interval between the note you pressed and middle C and then transposes the entire sequence up or down from the original starting note by that interval. When you pressed E, the computer calculated the four semitone interval and transposed the sequence up a major third.

3. Press G below middle C.

The sequence will again be transposed, this time a perfect fourth down from the original starting note.

4. Press middle C.

The sequence will be returned to its original key.

5. Press TRANSPOSE.

The TRANSPOSE button will go out and you may now play on the keyboard without causing transpositions.

You can also transpose individual tracks. For details on that function and for instructions on the many other possibilities for multitrack recording and for sequence modification, see the tabbed section, "Memory Recorder."

You have now completed a brief tour of Synclavier (R). The remaining sections in the "Synclavier (R) User Guide" may be read in any order.